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Recommended operating guidelines for box coring

1 . Methodology

The standard 'Box Corer' (Figure 1) is designed to take vertically undisturbed 'core' samples from the top of the seafloor, usually to a maximum depth of 50 cm, and it is suitable for almost every type of sediment. Operation is simple and straightforward. The corer is 'armed' by hooking the trigger mechanism to the hoist cable. It is then hoisted, usually over the back of the support vessel, and lowered into the water.

The corer is then lowered to the seafloor and embedded in the sediment. There are three methods commonly in use for driving the core into the sediment:

- The corer can be mounted in a frame which stands the corer upright on the seafloor prior to its 'firing'. Firing is activated be the weight being removed from the hoist cable as the frame rests on the seafloor, upon which lead weights act on lever arms and/or the shaft of the corer, driving it downwards. Adjusting the amount of lead controls the amount of pressure exerted on the box corer;
- The supporting frame contains the corer and compressed springs, which when fired, again by weight removed from the hoist cable as the frame rests on the seafloor, drive the corer into the sediment;
- No supporting frame is used on the seafloor. The corer's weight and additional lead weights mounted along the corer's penetration axis provide momentum during its decent, which drives it into the seafloor sediment.

Once the load has been removed from the hoist cable and the corer is embedded in the sediment, the trigger mechanism activates and automatically releases the box core door; this cuts through the sediment, sealing the bottom while the top of the corer is also closed over. Thus, the seafloor is sampled, including the top layer (even if this is only liquid), and the sedimentary layers of the sample are preserved.

To validate acoustically acquired habitat data sets and collect quantitative biological samples of seafloor fauna, sediment cores are an essential tool. Great care should be taken when choosing sample locations, to ensure that they will not only provide samples suitable for the desired purpose, but also to ensure the corer does not get damaged and that it can be deployed and recovered in a safe manner.

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2. Equipment

Numerous types of box corers are available for use in a range of situations and seabed types, but all conform, as a minimum, to the following requirements:

- A minimum of working parts and corrosion resistant;
- Sturdy enough to withstand repeated deck handling and bottom impact;
- A bulk and weight that allows safe operation;
- Correct orientation on the seabed for sample collection;
- A trigger release mechanism to ensure actuation on the seabed at the proper time;
- A constant sample area;
- Adequate penetration of the sediment to capture the animals present;
- A top door which closes tightly upon triggering and a bottom door which cuts cleanly through the sediment and also closes tightly – to ensure the sample is not disturbed by water movement during its retrieval;
- A low resistance to water on descent to minimise pressure-wave effects on the surface layer and animals;
- Easy retrieval with no loss of sample;
- Easy removal of sample and quick redeployment capability.

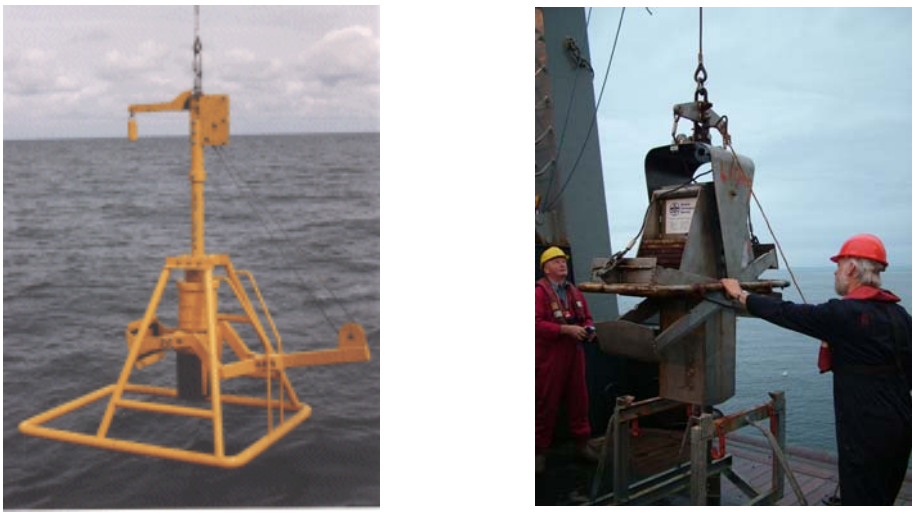

Figure 1. USNEL type 'frame-mounted' box corer (left) and BGS 'momentum' geological corer (right).

3. System operations

The onboard geotechnical or biological scientist is responsible for ensuring that the appropriate number of sample cores are taken at the required sampling station, as usually defined from acoustic data and, potentially, video

footage, and that they are within a tolerable distance from the sample location. The scientist is also responsible for accepting or rejecting a sample on inspection after recovery.

Prior to any coring operations, the assigned scientist will ensure:

- The box corer is clean and free from sample contamination;
- The corer is reloaded/rearmed and ready for deployment;
- Weather conditions are suitable to safely lower the corer to the seabed.

Prior to and during deployment/recovery of the box corer, the following shall be carried out or taken into account as appropriate:

- The box corer must be cleaned to avoid cross contamination of samples;
- The corer arming mechanism has been reset. Once armed, the safety pin should be inserted to prevent it triggering prior to deployment. Once the weight is taken on the cable, while lifting the corer over the side, this pin should be removed. Care must be taken when arming, both during deployment of the corer from the landing table and when removing the pin over the vessel side. There should be two people, one either side, steadying the corer during the deployment and recovery process;
- All personnel involved in deployment and recovery of the corer should wear appropriate personal protective equipment. This usually comprises hard-hat, boots, overalls, lifejacket and gloves, and may also include arrest harness and emergency position indicating radio beacons (EPIRB);
- The surveyor/party chief/chief Scientist will direct the vessel to a pre-defined location, as instructed by the geotechnical/biological scientist. When the bridge officer and surveyor are happy with the position of the vessel, taking into account prevailing weather and current directions, permission to deploy will be given. The bridge officer **must be** informed when the box corer is deployed, when it reaches the seabed, and when it is safely back aboard the vessel;
- When recovering the corer to the landing table, care must be taken to avoid the equipment striking the ship's hull, both to minimise disturbance of the sediment and prevent damage to either sediment or hull;
- The geotechnical/biological scientist will be responsible for the collection of the sample, storage and logging.

4. Operations at sea

Operations at sea are the responsibility of the onboard geotechnical/biological scientist.

4.1 Deployment of the box corer

Ensure the box corer is thoroughly rinsed between samples to prevent cross contamination of sediment. A hose connected to the seawater supply should be provided for this.

During deployment the vessel may be anchored, held by dynamic positioning, or be hovering over the deployment position.

The corer is deployed via a controlled launch from the deck and over the side of the vessel. Release of the safety locking pin on the trigger mechanism should take place at the last possible moment after the equipment is over the side. A controlled, slow descent is required until the equipment is below the sea surface. Thereafter, descent can be relatively rapid, in the case of seafloor frame-supported systems, to just above the seabed, where it is steadied and then loaded to the seafloor slowly to minimise impact, thus avoiding disturbing the sample. 'Momentum penetration' type corers should be lowered relatively rapidly, though in a controlled manner, to achieve adequate seafloor penetration.

4.2 Recovery of the box corer

Once the box corer has been activated, tension is then taken on the hoist cable, and the corer pulled out from the seabed and retrieved back to the surface where it is re-docked in the cradle. In soft fines, densely packed mud and clay sediments, extraction of the corer from the sediment may require notable force to overcome the suction formed by the cohesive sediments.

Before taking the unit onboard it is important to ensure that the trigger has been activated and that the box closures are securely in place. If this is not the case there is potential for the corer spade arms/doors to move in a scissors action while the corer is being handled to deck.

Do not attempt to work on the corer until it is re-stowed in its cradle AND properly de-activated.

On deck, the retrieved sediment within the box may be sub-sampled according to requirements. Again, care must be taken to ensure that this is done safely. Upon completion of all work at a particular site, the corer and deck area must be thoroughly washed down and cleared so that there is no danger of slipping or tripping when it comes to the next deployment. Corer cleanliness is important both to avoid jamming and also for avoidance of sample contamination.

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A sample will be rejected if there is any evidence of contamination or insufficient volume has been obtained, evidence of disturbance caused during recovery, or if it is not representative of the intended target seafloor based upon acoustic/video representation.

If a sample is deemed unacceptable, the contents are emptied and the box corer is thoroughly rinsed and cocked ready for re-deployment.

If the sample is accepted, it is photographed with a label clearly showing the sample number and an appropriate indication of scale (a rule or item of known size). A description of the sediment is recorded, including details of any layering in the appropriate log, along with types and approximate abundances of any obvious organisms. The core is then carefully emptied and stored for subsequent analysis.

5. Sample Logging

All box corer samples are recorded on the appropriate environmental log sheets. All attempted sampling efforts are noted as to whether they were accepted, rejected, empty or the corer failed to fire.

On inspection, each accepted sample will have details of sediment type and any specimens found. The following routine should be observed:

Box Corer sample:

- Sample and site ID
- Date and time of sample
- Approximate sediment classification (sand, silt and gravel content)
- Sediment colour
- Evidence and description of layering
- Approximate sediment volume (before sieving)
- Odour (presence of anoxic matter)
- Reference to deck or other photographs taken.

All representative samples are labelled with:

- Date
- Sample number
- Site number
- Survey or job number, code or name
- Client number, code or name.